FIG.1

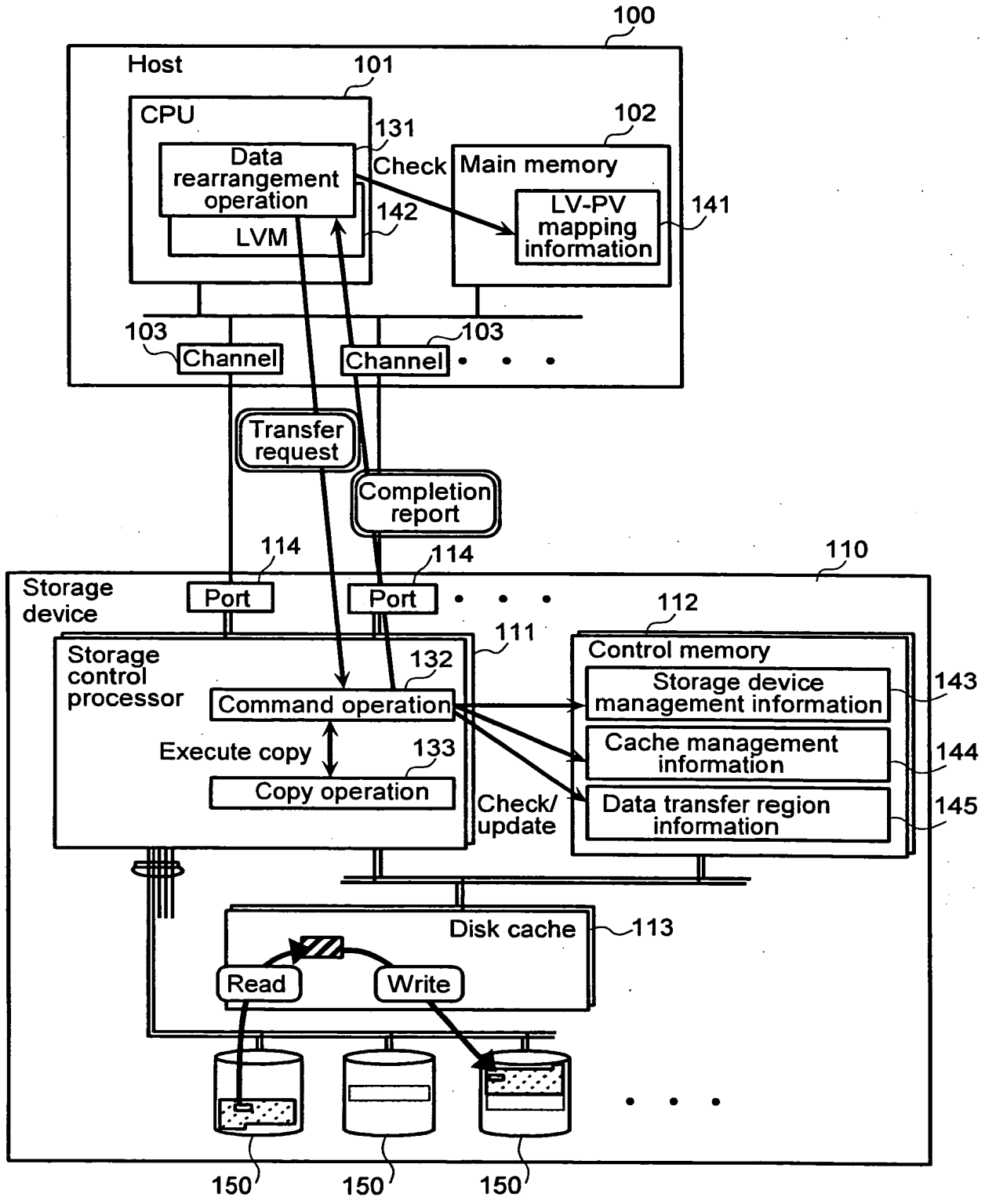

100
Host
101
CPU
131
Data rearrangement operation
Check
142
LVM
102
Main memory
LV-PV mapping information
141
103
Channel
103
Channel
Transfer request
Completion report
114
114
110
Storage device
Port
Port
112
111
Storage control processor
132
Command operation
Execute copy
133
Copy operation
Control memory
Storage device management information
143
Cache management information
144
Check/ update
Data transfer region information
145
Disk cache
113
Read
Write
150
150
150

FIG.2

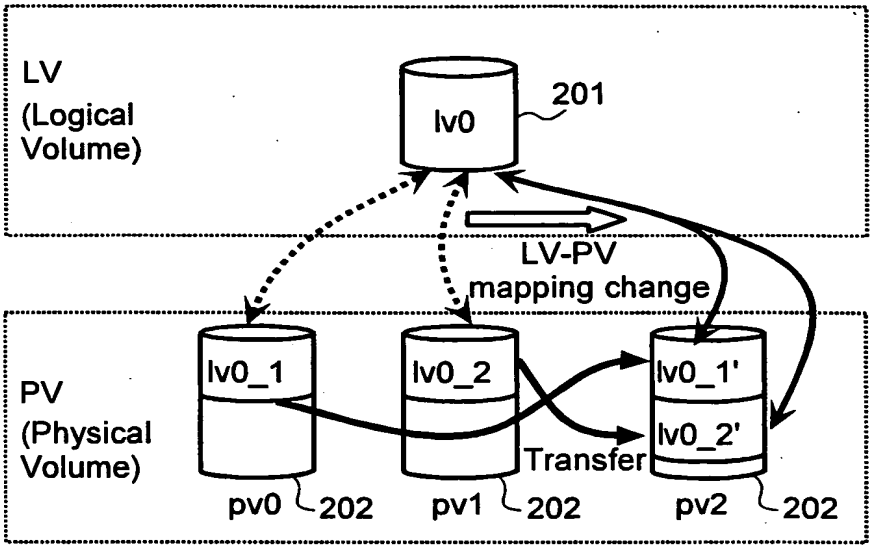

LV
(Logical
Volume)
lv0
201
LV-PV
mapping change
PV
(Physical
Volume)
lv0_1
lv0_2
lv0_1'
lv0_2'
Transfer
pv0
202
pv1
202
pv2
202

FIG.3

LV management information 300

PV list	301
LE count	302
LE size	303
LE-PE mapping information	310

LE-PE mapping information 310

311 LE number	312 PV name	313 PE number
0	/dev/dsk/c0t0d0	500
1	/dev/dsk/c0t0d0	501
2	/dev/dsk/c0t0d0	502
3	/dev/dsk/c0t0d0	503
	• • •	
499	/dev/dsk/c0t0d0	999
500	/dev/dsk/c1t0d0	100
501	/dev/dsk/c1t0d0	101
502	/dev/dsk/c1t0d0	102
	• • •	

FIG.4

PV management information 400

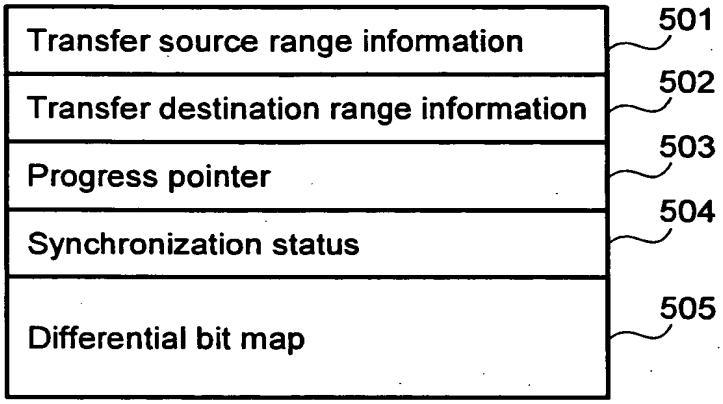
LV list	401
PE count	402
PE size	403
PE-LE mapping information	410

PE-LE mapping information 410

411 PE number	412 LV name	413 LE number
0	/dev/vg0/lv other	0
1	/dev/vg0/lv other	1
2	/dev/vg0/lv other	2
3	/dev/vg0/lv other	3
	• • •	
499	/dev/vg0/lv other	499
500	/dev/vg0/lv0	0
501	/dev/vg0/lv0	1
502	/dev/vg0/lv0	2
	• • •	

FIG.5

Data transfer region information 145



5,845,329

FIG.6

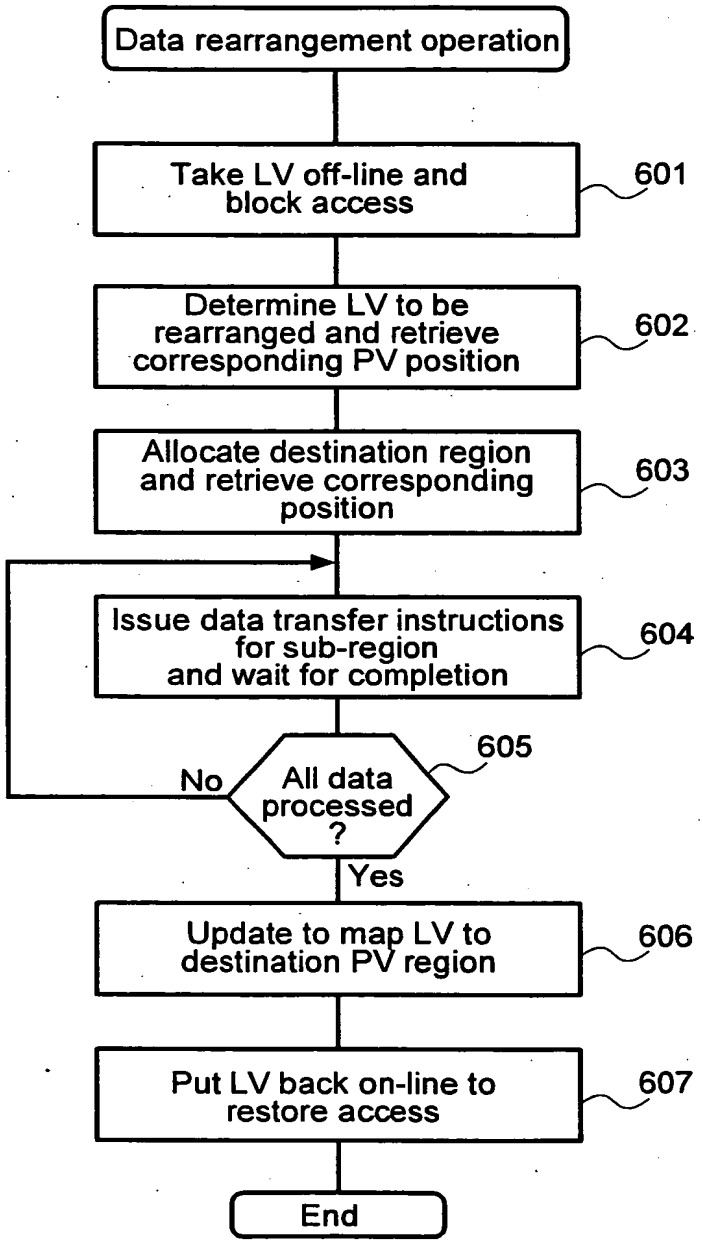

Data rearrangement operation
Take LV off-line and block access
601
Determine LV to be rearranged and retrieve corresponding PV position
602
Allocate destination region and retrieve corresponding position
603
Issue data transfer instructions for sub-region and wait for completion
604
All data processed ?
605
No
Yes
Update to map LV to destination PV region
606
Put LV back on-line to restore access
607
End

FIG.7

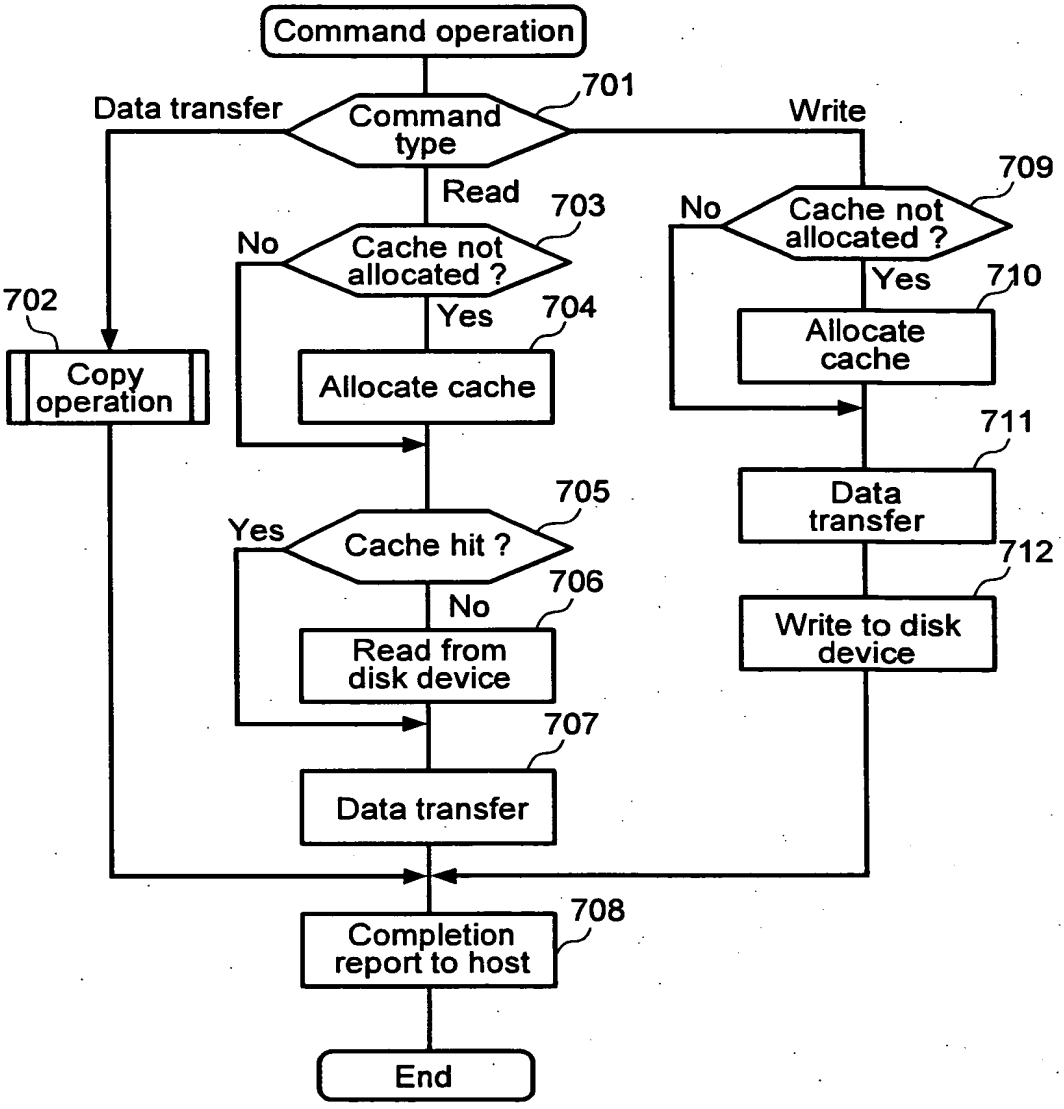

Command operation
701
Command type
Data transfer
Write
Read
703
No
Cache not allocated ?
Yes
704
Allocate cache
702
Copy operation
705
Yes
Cache hit ?
No
706
Read from disk device
707
Data transfer
709
No
Cache not allocated ?
Yes
710
Allocate cache
711
Data transfer
712
Write to disk device
708
Completion report to host
End

FIG.8

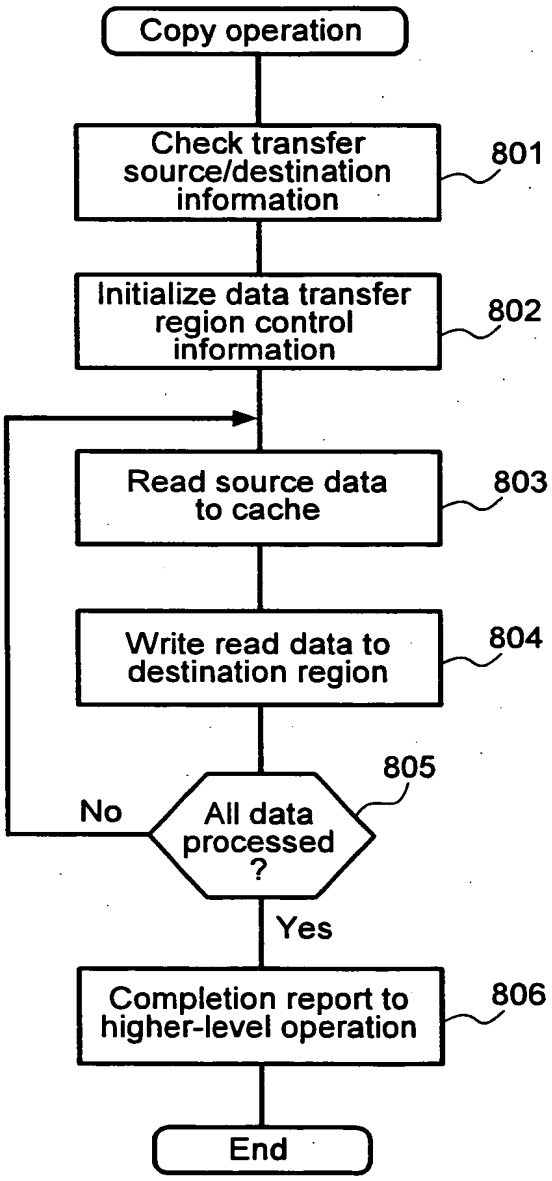

Copy operation
Check transfer source/destination information
801
Initialize data transfer region control information
802
Read source data to cache
803
Write read data to destination region
804
All data processed ?
805
No
Yes
Completion report to higher-level operation
806
End

FIG.9

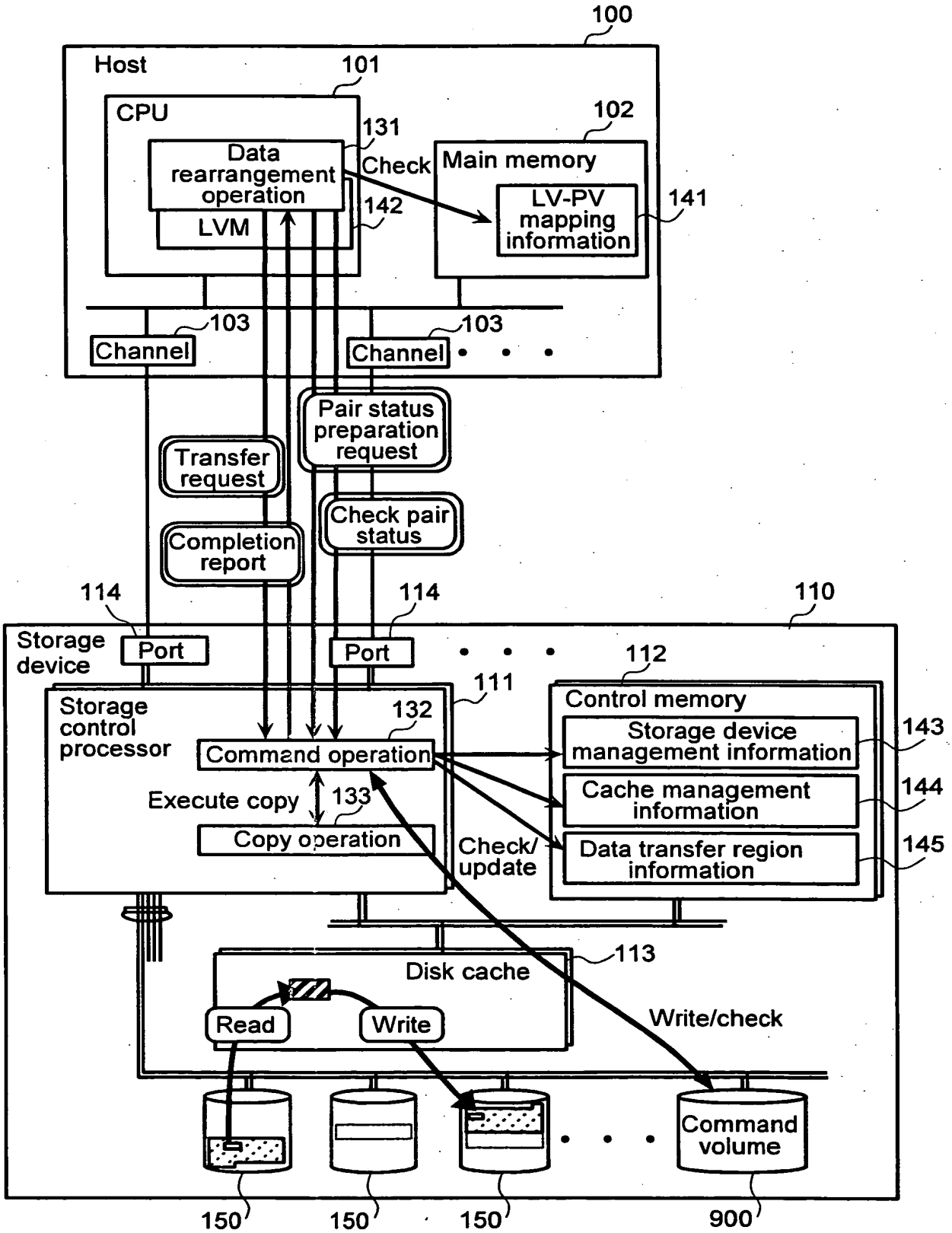

100
Host
101
CPU
131
Data rearrangement operation
Check
142
LVM
102
Main memory
LV-PV mapping information
141
103
Channel
103
Channel
Pair status preparation request
Transfer request
Check pair status
Completion report
114
114
110
Storage device
Port
Port
112
111
Storage control processor
132
Command operation
Control memory
Storage device management information
143
Cache management information
144
Execute copy
133
Copy operation
Check/ update
Data transfer region information
145
113
Disk cache
Read
Write
Write/check
Command volume
150
150
150
900

FIG.10

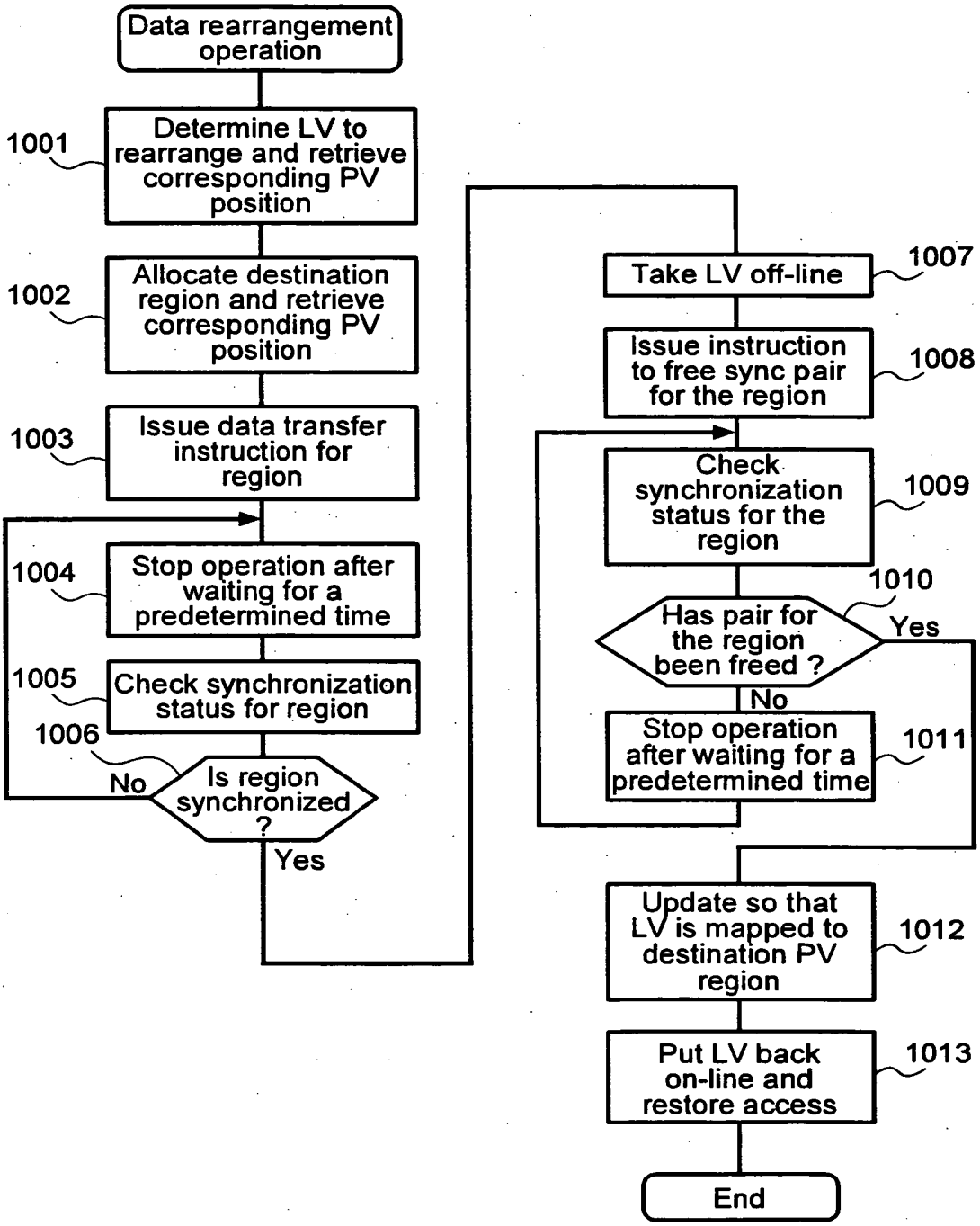

Data rearrangement operation
1001
Determine LV to rearrange and retrieve corresponding PV position
1002
Allocate destination region and retrieve corresponding PV position
1003
Issue data transfer instruction for region
1004
Stop operation after waiting for a predetermined time
1005
Check synchronization status for region
1006
No
Is region synchronized ?
Yes
1007
Take LV off-line
1008
Issue instruction to free sync pair for the region
1009
Check synchronization status for the region
1010
Has pair for the region been freed ?
Yes
No
1011
Stop operation after waiting for a predetermined time
1012
Update so that LV is mapped to destination PV region
1013
Put LV back on-line and restore access
End

FIG.11

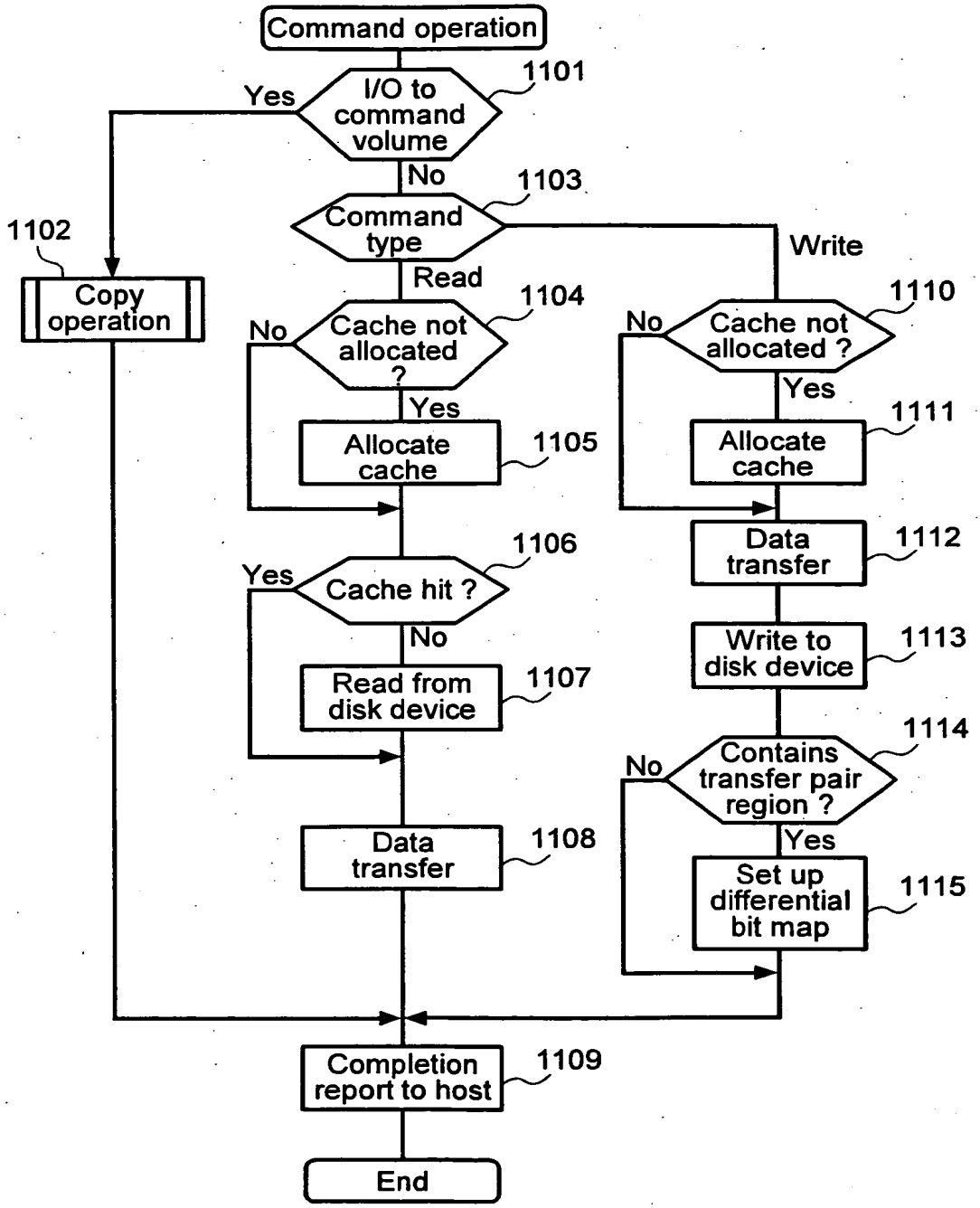
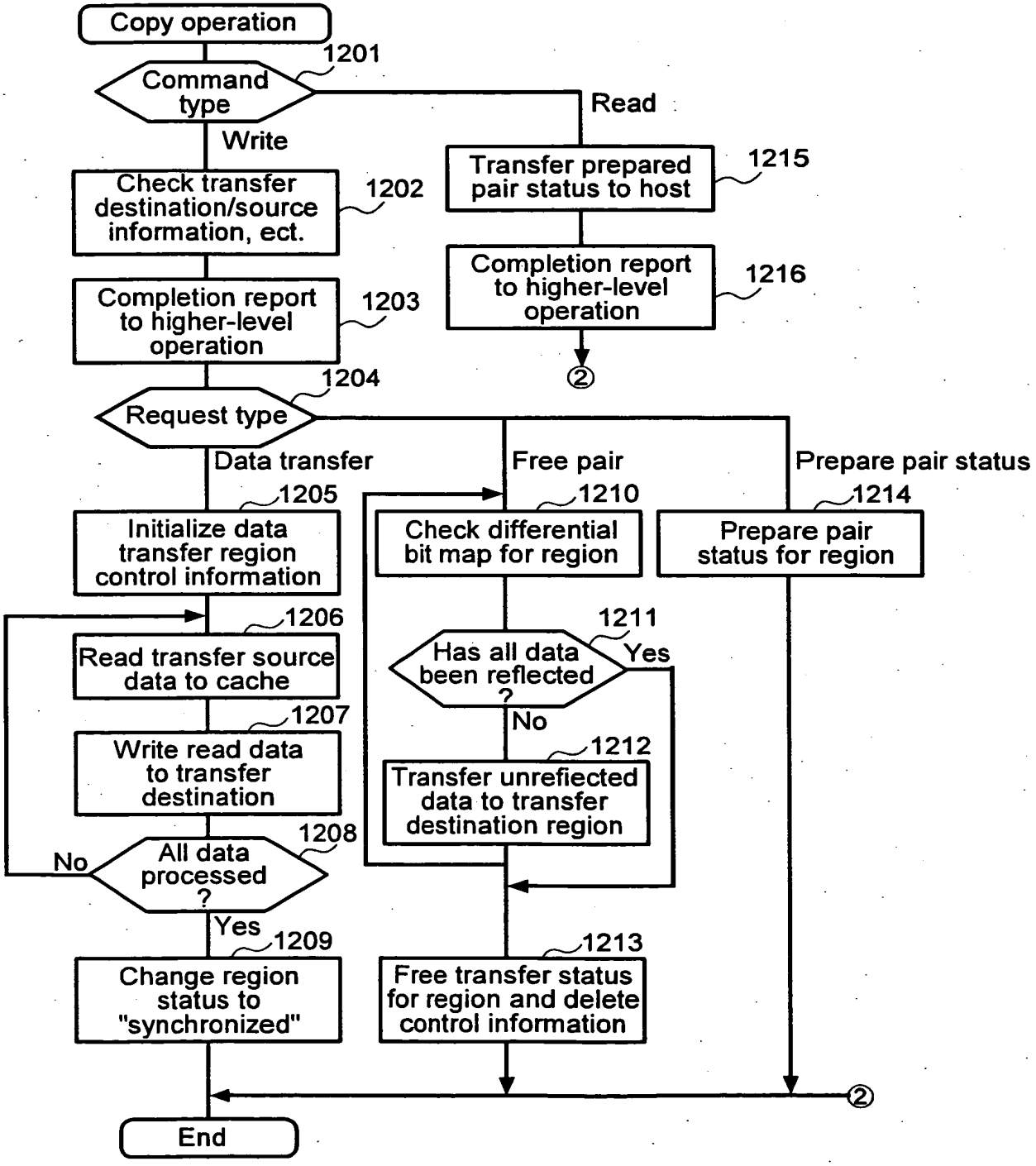

Command operation
1101
I/O to command volume
Yes
No
1103
Command type
1102
Copy operation
Read
Write
1104
Cache not allocated ?
No
Yes
Allocate cache
1105
1106
Cache hit ?
Yes
No
Read from disk device
1107
Data transfer
1108
1110
Cache not allocated ?
No
Yes
1111
Allocate cache
Data transfer
1112
Write to disk device
1113
1114
Contains transfer pair region ?
No
Yes
Set up differential bit map
1115
Completion report to host
1109
End

FIG.12


Copy operation
1201
Command type
Write
Read
Check transfer destination/source information, ect.
1202
Completion report to higher-level operation
1203
Transfer prepared pair status to host
1215
Completion report to higher-level operation
1216
②
1204
Request type
Data transfer
Free pair
Prepare pair status
1205
Initialize data transfer region control information
1210
Check differential bit map for region
1214
Prepare pair status for region
1206
Read transfer source data to cache
1211
Has all data been reflected ?
Yes
No
1207
Write read data to transfer destination
1212
Transfer unreflected data to transfer destination region
1208
No
All data processed ?
Yes
1209
Change region status to "synchronized"
1213
Free transfer status for region and delete control information
②
End